

MINE ASSESSMENTS FOR BAT ACTIVITY, GARNET RESOURCE AREA, BLM: 1997

A Report to:

USDI, Bureau of Land Management
Garnet Resource Area
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ABSTRACT

Seven abandoned mines or “mine sites” in the Garnet Resource Area, Butte District-BLM were surveyed for actual or potential bat use during July 1997. Mines and mine sites included the Linton Mine, “Leaking Red Adit”, Mountain View Mill site, and “Bear Den adits” (all in the Garnet Range), Silver King Mine and Laurie B adit (west of Philipsburg), and the Blackfoot City and Toy Town area (north of Avon). Mines were inspected visually for bat activity and in some cases monitored overnight using ultrasound bat detectors. At some sites, surrounding terrain was also monitored overnight with bat detectors. All sampling provided a more complete picture of bat presence and potential use of abandoned mines on the Garnet Resource Area.

Three mine sites (Linton, Mountain View, Silver King) showed evidence of bat use. Species detected at these sites included unidentified *Myotis* (*Myotis* sp.), Western Long-eared *Myotis* (*Myotis evotis*), Big Brown Bat (*Eptesicus fuscus*), Silver-haired Bat (*Lasionycteris noctivagans*), Hoary Bat (*Lasiurus cinereus*) and Townsend’s Big-eared Bat (*Corynorhinus* [= *Plecotus*] *townsendii*). Townsend’s Big-eared Bat is a BLM Special Status species and a Montana Natural Heritage Program Animal Species of Special Concern. Silver-haired and Hoary bats generally use tree cavities as roost and hibernation sites; their detection at mine sites indicates foraging activity outside of the mines rather than use of the mines themselves. The other three species (and unidentified *Myotis*) use mines and caves for roosts and hibernacula, although other sites may be used for these purposes as well.

The Mountain View and Silver King mines have the potential for year-round bat use; the Linton Mine is not suitable as a hibernaculum, but otherwise could be used as a day/night roost and perhaps a maternity roost. The Laurie B adit could serve as a small roost or hibernaculum, even though bat use was not noted. Measures to protect or modify these four sites for bat use are recommended.

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INTRODUCTION

Knowledge of Montana's bat fauna is fragmentary. The most recent state-wide summary of bat distribution and habitat use (Hoffmann and Pattie 1968, Hoffmann et al. 1969) has since been supplemented with the addition of two species previously undocumented in the state (see Swenson and Shanks 1979, Shryer and Flath 1980). In addition, several regional surveys have been conducted in the intervening years (e.g., Jones et al. 1973, Swenson and Bent 1977, Worthington and Ross 1990, Worthington 1991, Roemer 1994, Hendricks and Genter 1997, Hendricks et al. 1995, 1996) that contribute to our understanding of bat faunistics in Montana. Nevertheless, site surveys have often been brief (lacking the thoroughness of an intensive survey), and many areas of Montana remain unsurveyed. Thus, much remains to be learned about the distribution, abundance, seasonal movements, and reproductive biology of bat species in the state.

Five species of bats found in Montana (Fringed Myotis, *Myotis thysanodes*; Northern Myotis, *Myotis septentrionalis*; Spotted Bat, *Euderma maculatum*; Townsend's Big-eared Bat, *Corynorhinus* [= *Plecotus*] *townsendii*; Pallid Bat, *Antrozous pallidus*) are on the 1997 Montana Natural Heritage Program (MTNHP) "Animal Species of Special Concern" list, with one additional species (Yuma Myotis, *Myotis yumanensis*) on the informal "Watch List." Four of these species were formerly listed by the U.S. Fish and Wildlife Service as Candidates (C2) for threatened or endangered status. Three bat species on the MTNHP lists (all but the *Myotis* species) are classified as Sensitive by the U.S. Forest Service or Special Status by the BLM. Listed species are of concern for various reasons including rarity, limited distribution, or loss of habitat. All listed species, with the exception of the Spotted Bat (*Euderma maculatum*), use caves or mines during some portion of their annual cycle. In Montana, 11 (79%) of 14 bat species (all but the Spotted Bat, Silver-haired Bat [*Lasionycteris noctivagans*] and Hoary Bat [*Lasiurus cinereus*]) rely primarily on caves or mines for roost or hibernaculum sites.

Several species of North American cave-dwelling bats have been adversely affected in recent decades by a variety of human-induced environmental changes to caves, including cave closures, impoundments, and vandalism or other human disturbances (see Humphrey 1978, Tuttle 1979, LaVal and LaVal 1980, Sheffield et al. 1992). These, and landscape changes such as deforestation and agricultural development, have forced many bat species to abandon traditional sites in search of new roosts and hibernacula. As a result, some cave-dwelling species in the East and Midwest have been federally listed as threatened or endangered. Mines offer a variety of subterranean microclimates similar to those in natural caves (Tuttle and Stevenson 1978, Tuttle and Taylor 1994) and can provide suitable habitat for roosting and hibernating bats. In fact, abandoned mines now serve as principle roosts and hibernacula for many cave-dwelling species (Tuttle and Taylor 1994), and are important for populations occupying marginal habitats (Gates et al. 1984) in areas where there are continued threats to primary natural roosts. It is widely acknowledged that natural cave environments are the most stable and desirable long-term habitats for bats, but abandoned mines may provide a suitable alternative. Mines should be protected and conserved wherever possible to maintain healthy cave-dependent species, such as bats.

Mine reclamation (including closure to restrict human access) is of interest to wildlife managers because reclamation activities can have significant negative impacts on bat populations (see Sheffield et al. 1992, Richter et al. 1993), unless closure is done in such a way as to

minimize disturbance to bats in the mines affected. Because the majority of bat species in Montana use caves and mines, it is especially important to determine the magnitude of mine use by bats in the state and identify situations where abandoned mines can be made safe for humans while maintaining their attractiveness to bats.

Increased concern over bat populations nationally, coupled with increased emphasis on the closure of abandoned mines on public lands, stimulated BLM biologists of the Garnet Resource Area to begin assessment of abandoned mines for bat activity prior to mine closure. The purpose of this report is to document findings of abandoned mines bat inventories conducted on the Garnet Resource Area during summer 1997. Mines suitable as bat habitat during part or all of the year are identified, and measures are suggested to protect the mines from human intrusion while maintaining access for bats.

METHODS

Assessment of abandoned mines for bat activity on the Garnet Resource Area was conducted 25-29 July, 1997. Abandoned mines to be inspected were chosen by BLM personnel. Mine sites visited included the Linton Mine, "Leaking Red Adit", Mountain View Mill and adits, and "Bear Den adits" in the Garnet Range, the Silver King Mine and Laurie B adit west of Philipsburg above Rock Creek, and the Blackfoot City-Toy Town area north of Avon. Mine portals, adits and buildings were visually inspected for bat spoor (e.g., droppings, insect parts). Configuration and size of portals were recorded and notes taken on entrance stability. When deemed safe and suitable, mines were entered and inspected internally. If possible, mine air temperature and humidity were recorded at fixed distances from portals; air temperature was measured with a mercury thermometer, relative humidity was measured with a Bacharach sling psychrometer. Air movement and direction were also noted.

Ultrasound detectors were used at all sites (except the "Bear Den adits" and Laurie B adit) to record overnight bat activity. At mine sites monitored, at least one detector was placed to record bat activity away from mine entrances, usually in a forest clearing or at a water source. I recorded 1) an index of sky conditions from 0-6 (clear to showers), 2) Beaufort wind scale from 0-5 (no wind to winds 19-24 mph), and 3) ambient temperature at the time detector units were placed. Weather during the field inventories was clear, calm and warm.

Thomas and West (1989) provide a general discussion of sampling methods for bats. Each method has strengths and weaknesses for survey work, with no single method being definitive. Ideally, a combination of mist-nets and bat detectors would be employed at a given site in order to obtain the most accurate picture of distribution and relative abundance. Mist-netting has the advantage of allowing in-hand identification of individuals and collection of data on sex and reproductive condition, neither of which are obtainable with bat detectors. Some bats may escape capture in nets, however, and some species present at a particular site may go undetected. Also, mist-netting is time-consuming, and therefore permits fewer sites to be surveyed within the allotted time period. Mist-netting was not conducted at any site during the mine assessments reported here.

Data collected with bat detectors can supplement or serve in lieu of mist-net data. Microchiropteran bats use a variety of ultrasonic vocalizations as echolocation aids for navigation and prey capture. Fortunately, a number of studies have determined that the signals emitted by bats can be used to distinguish among many species (e.g., Barclay 1986, Fenton and Bell 1981, Fenton *et al.* 1983, MacDonald *et al.* 1994). This characteristic permits the assessment of species-presence during inventory work through use of portable ultrasound bat detectors. Bat detectors are not without drawbacks, however. Call duration, time between calls, call structure, and call frequency can vary significantly with habitat and between individuals (Brigham *et al.* 1989, Erickson 1993), sometimes making species identification difficult. In Montana, *Myotis evotis* was the only species of *Myotis* which can be distinguished with accuracy from other members of the genus using a bat detector. Design of echolocation-monitoring studies using bat detectors is discussed by Hayes (1997).

ANABAT II bat detectors (Titley Electronics, Ballina, Australia) were used during field work in 1997. These detectors are sensitive to broadband ultrasonic calls common in bat vocalizations (usually 20-180 kHz) . Ultrasonic signals in the range of bat vocalizations are captured, converted to an audible frequency (up to 10 kHz), and recorded on magnetic tape. Detector units (consisting of the detector, timer/tape-driver, and a voice-activated cassette tape recorder) were set up before dusk at mine portals (facing into the adit), bodies of water and forest openings (where bat activity would be expected) and left in place overnight; usually one cassette tape was sufficient to record activity at a single site. Detectors were sensitive to bats within a minimum range of 20-30 m. Recorded tapes were returned to the laboratory and analyzed on an IBM compatible PC using an ANABAT II ZCA Interface Module and software. Assignment of vocalizations to a particular species of bat was achieved by matching field recordings with a reference set of calls obtained from captured individuals, in addition to matching call characteristics with those reported in the literature.

RESULTS

Linton Mine: The Linton Mine (T12N R15W S30NW) is located at an elevation of about 4600 ft above Cramer Creek, north of Beavertail Campground along Interstate 90. The mine is primarily a large chamber perhaps 250 ft by 250 ft and 100 ft high. The mine is cave-like, with several “stopes” ascending into the upper portions of the drift face, and a shallow interior adit on the outer wall below upper portals. No true twilight occurs in the mine during the day, except perhaps in the interior adit and remote parts of the stopes (which were not inspected). The main portal is quite large (perhaps 40 ft by 40 ft), and two large upper portals also allow considerable light into the main mine room.

Linton Mine was inspected on 25 July. Mine air temperature was 67.5 F (19.5 C) at 16:30 about 150 ft from the main portal below the interior adit; relative humidity (R.H.) = 40%. There was a slight amount of moisture on the wall below the stopes, otherwise the mine was dry. Outside ambient temperature was 71.0 F (21.0 C), R.H. = 38%.

No bat spoor was detected, although Rock Doves and a pair of Red Crossbills were present in the mine, and Bushy-tailed Woodrat (*Neotoma cinerea*) droppings were noted. Bat detectors were set at the main portal and one of the upper portals and left overnight. Bat species detected were unidentified Myotis, Western Long-eared Myotis (*Myotis evotis*), Big Brown Bat (*Eptesicus fuscus*), Silver-haired Bat (*Lasionycteris noctivagans*), Hoary Bat (*Lasiurus cinereus*), and Townsend’s Big-eared Bat (*Corynorhinus [=Plecotus] townsendii*); a “long-eared bat” was flushed from the mine during the day in late August (BLM personnel, pers. comm.), and most likely was Townsend’s Big-eared Bat. Most activity (90.0% of 331 passes) recorded by the two detectors was either unidentified Myotis (147 passes) or Big Brown Bat (151 passes); Townsend’s Big-eared Bat was detected on 5 (1.5%) of the passes.

A bat detector was set overnight along Cramer Creek (T12N R15W S30NE) in streamside riparian habitat. Unidentified Myotis, Big Brown Bat, Silver-haired Bat, and Townsend’s Big-eared Bat were detected in 137 total passes. Most passes (88.3%) were attributed to unidentified Myotis or Big Brown Bat; Townsend’s Big-eared Bat was identified on 2 (1.5%) of the passes.

“Leaking Red Adit”: The “Leaking Red Adit” is located above Union Creek in T12N R15W S11NW at about 4600 ft elevation. Water discharging from the adit (entrance now collapsed) stains rocks a reddish color, hence the name. Because there is no significant opening to the workings, the adit was not entered or described. A bat detector was set opposite the adit, overlooking Union Creek, on 25 July and left overnight; the site is mostly spruce-fir forest along the creek. Only 4 passes by bats were recorded, 3 by unidentified Myotis and 1 by Long-eared Myotis.

A second bat detector was set in T12N R15W S10NW at 5100 ft, about 0.5 mi NW of the mine site just off of the access road. The habitat at this site was shelterwood Douglas-fir. Equipment malfunction precluded an accurate recording session, but unidentified Myotis and Big Brown Bat were recorded at this site on the night of 25 July.

Mountain View Mill Site: This site is located about 0.5 mi E of the town of Garnet in T12N

R14W S2SW, between 6140-6160 ft elevation in mature Douglas-fir forest. The site consists of several partly collapsed mill buildings, an adit with a culvert gate at the mill with water discharge, and two adits upslope from the mill. The mill buildings were considered unlikely to be used as a maternity site. The upslope east adit was formerly protected with a cable net that has been vandalized and removed; the upslope west adit is still covered with a cable net.

Dimension the entrance of both adits is about 2 x 2 m; both entrances are partly collapsed.

The upslope east adit was entered on 26 July. The adit runs generally straight back into the hillside for 62.5 ft, where it forks perpendicular to the entrance passage. Some slumping has partly filled the adit at the fork (an obvious slump is present on the ground surface in the forest). Mine air temperature at the fork was 42.0 F (5.5 C), R.H. = 98% at 17:35. I did not inspect the mine beyond this point. Outside temperature and R.H. were 66.5 F (19.0 C) and 37%, respectively, at this time. Air movement at the portals was not detected at either upslope adit. No evidence of bat use was noted, but I did see a Bushy-tailed Woodrat nest and woodrat droppings.

Bat detectors were left overnight on the evening of 26 July at both upslope adits and overlooking the small pond near the portal of the gated mill-site adit. Equipment continued to malfunction, but bats were recorded at each location. At the upslope east adit, 4 identifiable passes were noted (1 unknown, 2 unidentified *Myotis*, 1 Big Brown Bat, 1 Townsend's Big-eared Bat). At the upslope west adit, 4 unidentified *Myotis* passes were identifiable. At the mill-site adit, 22 passes were identified (13 unidentified *Myotis*, 2 Big Brown Bat, 7 unknown).

“Bear Den Adits”: This collection of small workings is located above the east fork of McGinnis Creek in T13N R14W S33NE. Four adits are present. The northernmost of a pair is collapsed at the entrance; the other adit at this site angles down into the hill and was not entered. A lone adit to the south of the paired adits also angles down into the hill for about 25 ft; there is a side passage paralleling the hillside to the south for about 25 ft. Mine air temperature 15 ft from the portal was 47 F (8.0 C) at 15:00, outside ambient temperature was 67.5 F (19.5 C). Both open adits are shallow cold-air traps. A fourth adit, discharging water with the portal boarded, was not entered.

No bat detectors were left at this collection of adits.

Silver King Mine: The Silver King Mine is located between 5160-5340 ft in T6N R15W S5SE, at the mouth of Sluice Gulch on the south side, near Rock Creek west of Philipsburg. Numerous pits cover the hillside, and four adits at different levels form the main parts of the underground workings. The portal at lowest level (near the creek) is loosely sealed with a wooden door 8 x 10 ft in height and width. The second level portal is a large opening at least 10 x 10 ft. The third level portal (near a metal work shed and garage) is partly collapsed and protected by a wooden door; the entrance is about 6.5 x 6.5 ft in size. The fourth (upper-most) level portal is slightly blocked by a screen a few feet away from the entrance and in front of a small debris pile.

I examined the Silver King Mine on 27 July. Level 1 was entered at 12:35 and inspected up to where the adit is collapsed about 30 ft beyond the door. At the time a gentle flow of cold air was exiting the adit. Outside ambient temperature at the time was 78.0 F (25.5 C), R.H. = 29%. No sign of bats was noted in Level 1. Level 2 was entered at 16:30 and inspected to a

large pile of collapsed material about 50 ft beyond the portal, beyond which I did not explore; a gentle flow of cold air was exiting this adit at the time. No sign of bats was noted in Level 2. Level 3 was entered at 14:00. Outside ambient temperature and R.H. at the entrance were 79 F (26.0 C) and 26%, respectively. A gentle flow of cold air was exiting this adit, also. The workings extend back into the mountain an unknown distance. There are numerous stopes on this level, none of which I explored. I stopped my exploration of this level at the escapeway R 2-17, apparently connected with Level 2, about 700 ft from the portal. Mine air temperature at this point was 46.0 F (8.0 C), R.H. = 94%. Level 4 was entered at 15:15. Outside ambient temperature and R.H. at the entrance were 80.0 F (26.5 C) and 29%, respectively. Once inside, I detected a gentle flow of warm air entering the adit. There are numerous stopes on this level, too; none of these were explored. Mine air temperature at about 360 ft from the portal (at a ladder ascending a stope) was 61.0 F (16.0 C), R.H. = 49%. Scattered bat feces and moth wings were noted this far into the adit, being most numerous in the first 130 ft from the portal. A slight breeze was still detectable at this point. I followed this level as far as the drift face, about 615 ft from the portal. The last 130 ft descend slightly and become a cold air trap. Mine air temperature at the drift face was 47.0 F (8.5 C), R.H. = 100%. Before reaching the drift there are passages apparently descending to Level 3; these were not explored.

Bat detectors were set at each level and along a road in forest near Level 2. The detector at Level 1 malfunctioned, but at least 1 pass (unknown species) was identified; this detector was positioned to monitor activity over Sluice Creek, not at the portal. At Level 2, 11 passes were detected near the portal (7 unidentified *Myotis*, 3 Silver-haired Bat, 1 Big Brown Bat). Near Level 2 in young Douglas-fir forest, 8 passes were detected (6 unidentified *Myotis*, 2 Big Brown Bat). At Level 3, no bat activity was detected. At Level 4, 21 passes were identified at the portal (14 unidentified *Myotis*, 1 Western Long-eared *Myotis*, 1 Silver-haired Bat, 3 Big Brown Bat, 2 Townsend's Big-eared Bat).

Laurie B Adit: This adit is located on the south side of Sluice Gulch at about 5200 ft elevation in T6N R15W S4NW, about 1 mi east of the Silver King Mine. The portal is mostly filled with vegetation and collapsed. The entrance opening is 2 x 5 ft. Beyond the entrance, the adit is about 6 ft in height and width. The adit is generally level to the drift face, about 65 ft from the portal. On 27 July at 13:15, mine air temperature at the drift face was 44.0 F (7.0 C), R.H. = 94%. Outside ambient temperature and R.H. were 75.0 F (24.0 C) and 32%, respectively. No sign of bat activity was noted and a detector was not set at this mine site.

Blackfoot City-Toy Town area: This area north of Avon included four sites to be examined: Opsata Mine near Ophir Creek (T11N R8W S25SE), structures near the mouth of Tiger Gulch (T11N R8W S25SE), an adit in Carpenter Creek (T11N R7W S32NW), Toy Town adit near Woodson Gulch (T11N R7W S29SW). Elevation between the Opsata Mine and Toy Town range from 5400-5600 ft. The Opsata Mine consists of a shaft 20 ft deep with an entrance opening of 3 x 3 ft, and a series of three shallow adits upslope behind the wooden structure around the shaft. The bottom adit is collapsed with no opening, the middle adit is about 20 ft long and descends into the hillside (entrance 6 x 6 ft), the upper adit is similar to the middle adit in size and characteristics. At Tiger Gulch, no subsurface mine workings were present. Two adits were

present in Carpenter Creek; only the adit on the north side of the creek was visited. The entrance is partly collapsed with timbers and debris and was not investigated further. Near Toy Town, an adit is present on the north side of the road up Carpenter Creek. The portal is mostly collapsed. No air movement was detected at the entrance. The adit was entered at 13:20 on 28 July. Beyond the portal the adit is 4 ft high and wide; adit walls were wet. There is considerable standing water in the mine, and about 50 ft beyond the portal a deep pool of water prevented further exploration. At this point mine air temperature was 43.5 F (6.5 C), R.H. = 97%. Outside ambient temperature and R.H. were 76.0 F (24.5 C) and 51%, respectively.

Bat detectors were set overnight on 28 July near the head of the north fork of Carpenter Creek at Boellard Cabin (T11N R7W S29NE), on Carpenter Creek where the road turns north and away from the creek in Section 29, at the Toy Town adit, near the building at the mouth of Tiger Gulch, and on Ophir Creek just downhill from the Opsata Mine. Defective equipment again provided only limited monitoring at some sites. At Boellard Cabin (young Douglas-fir forest), 2 passes by unidentified *Myotis* were detected. At Carpenter Creek (young Douglas-fir forest), 16 passes were identified (15 unidentified *Myotis*, 1 Big Brown Bat). At Toy Town adit no bats were detected. At Tiger Gulch (Douglas-fir and aspen), 59 passes were identified (48 unidentified *Myotis*, 8 Big Brown Bat, 3 unknown species). On Ophir Creek (riparian cottonwood habitat) 39 passes were identified (26 unidentified *Myotis*, 1 Silver-haired Bat, 10 Big Brown Bat, 2 Townsend's Big-eared Bat).

DISCUSSION

Five species of bats were identified during surveys of abandoned mines in the Garnet Resource Area (see Appendix). Unidentified bats and unidentified *Myotis* were also detected at three and five of five areas, respectively, where bat detectors were deployed. *Myotis* species potentially present (see Hoffmann and Pattie 1968, Hoffmann et al. 1969) but indistinguishable from vocalizations include California *Myotis* (*M. californicus*), Western Small-footed *Myotis* (*M. ciliolabrum*), Little Brown *Myotis* (*M. lucifugus*), Fringed *Myotis* (*M. thysanodes*), Long-legged *Myotis* (*M. volans*), and Yuma *Myotis* (*M. yumanensis*).

Two of five species identified (Silver-haired Bat, Hoary Bat) are considered “tree bats” that rarely if ever use caves or mines for roosts or hibernacula (Nagorsen and Brigham 1993); both species are migratory, with the majority of individuals probably leaving the region during autumn and winter. The presence of these two species near abandoned mines is more likely a reflection of their use of the areas for feeding and roosting in the nearby forests. For the other three species (Western Long-eared *Myotis*, Big Brown Bat, Townsend’s Big-eared Bat) detected during the 1997 abandoned mine inventories, there are widely-scattered winter (November-March) records in Montana (Heritage Program, unpublished data), indicating the potential for their presence in hibernacula on the Garnet Resource Area. Winter records also exist for Little Brown *Myotis* and Long-legged *Myotis* from Missoula and Granite counties (Heritage Program, unpublished data), indicating the likelihood of these species also being present in hibernacula on the Garnet Resource Area.

Of the mine areas inspected, four have characteristics that make them suitable as real or potential bat habitat. 1) The Linton Mine, like a large dry cave, offers many sites for roosting by small numbers of bats. That a bat was flushed by a BLM employee in late August underscores the observation that some bats use this mine as a day roost. Townsend’s Big-eared Bat (BLM Special Status species) was detected at this mine; significant feeding activity also occurs here. Because the mine is relatively open and shallow, the site is unsuitable as a hibernaculum. 2) The Mountain View uphill adits appear suitable as roosts and/or hibernacula. Although the underground configuration of each uphill adit is unknown as they were not fully explored, both appeared to be relatively dry with little air movement, and the east adit is deep enough and humid enough to protect hibernating bats from winter extremes. Bat activity at each adit further indicates that they are being used during summer by some individuals. Townsend’s Big-eared Bat was detected at this mine. 3) The Silver King Mine is by far the most likely abandoned mine to harbor significant numbers of hibernating bats, as well as being used by bats during summer. The mine is complex and deep, with significant air movement and many sites for roosting and hibernation. Townsend’s Big-eared Bat was detected at this mine. 4) The Laurie B adit, although relatively shallow, has the potential for use as a roost and, possibly, a small hibernaculum. The mine is dry, but relative humidity at the back of the adit was nearly saturated (94%) at the time it was visited, and the mine temperature (44.0 F) was also in equilibrium with the annual mean temperature for that elevation.

The mine workings of the Blackfoot City-Toy Town area, “Leaking Red Adit” and “Bear Den Adits” had low potential for use by bats.

RECOMMENDATIONS

- 1) Four abandoned mine sites offer real or potential habitat for bats. Measures should be taken to maintain access for bats to these sites while preventing unauthorized access by humans.
- 2) Install gates at adits of the Laurie B (1 adit), Silver King (upper 2 adits), and Mountain View (2 upslope adits) mines. The lower 2 adits of the Silver King Mine could be closed, so long as air flow is not impeded; gating of these two adits should be considered if not cost-prohibitive.
- 3) Use recommended designs and dimensions for gates (e.g., see White and Seginak 1987, Tuttle and Taylor 1994, Dalton and Dalton 1995). Gated culverts may be suitable at some or all sites.
- 4) The Linton Mine configuration makes it unsuitable for gate installation without drastic modification of the mine. Maintain current barriers, or consider reconstructing the mine such that the shape is more like a typical adit with stopes. This procedure is not recommended, except that it offers a way of reclaiming waste rock (a potential point source of contamination to Cramer Creek), while providing potentially suitable habitat for bats. If this procedure is pursued, then the “new” entrance should be fitted with a gate and lock. Because the mine modifications would be experimental, the reconstructed mine should be monitored at least once a year for use by bats. This allows evaluation of the process for possible use at other sites in the future.
- 5) Conduct additional abandoned mine inventories for potential use by bats. Revisit gated mines every few years to check for use by bats.

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**APPENDIX 1. BATS DETECTED AT MINE SITES AND NEARBY AREAS
ON THE GARNET RESOURCE AREA DURING 1997.**

Appendix 1. Bats detected at mine sites and nearby areas on the Garnet Resource Area in 1997.

Location	Date	Bat species ^a
Linton Mine (T12N R15W S30NW)	25 July	MYSP MYEV EPFU LANO LACI COTO
Cramer Creek (T12N R15W S30NE)	25 July	MYSP EPFU LANO COTO
“Leaking Red Adit” (T12N R15W S11NW)	25 July	MYSP MYEV
“Leaking Red Adit” road (T12N R15W S10NW)	25 July	MYSP EPFU
Mountain View Mine (T12N R14W S2SW)	26 July	UNKN MYSP EPFU COTO
Silver King Mine (T6N R15W S5SE)	27 July	UNKN MYSP MYEV LANO COTO
Silver King Mine forest site (T6N R15W S5SE)	27 July	MYSP EPFU
Opsata Mine (Ophir Creek) (T11N S8W S25SE)	28 July	MYSP EPFU LANO COTO

Appendix 1 (cont). Bats detected at mine sites and nearby areas on the Garnet Resource Area in 1997.

Location	Date	Bat species ^a
Mouth of Tiger Gulch (T11N R8W S25SE)	28 July	UNKN MYSP EPFU
Carpenter Creek (T11N R7W S29SE)	28 July	MYSP EPFU
Boellard Cabin area (T11N R7W S29NE)	28 July	MYSP

^a UNKN-unknown bat species, MYSP-*Myotis* sp.(unidentified *Myotis*), MYEV-*Myotis evotis* (Western Long-eared *Myotis*), EPFU-*Eptesicus fuscus* (Big Brown Bat), LANO-*Lasionycteris noctivagans* (Silver-haired Bat), LACI-*Lasiurus cinereus* (Hoary Bat), COTO-*Corynorhinus* (= *Plecotus townsendii* (Townsend's Big-eared Bat)).